Example 2.
Using a spring-loaded launcher, a cart is quickly accelerated from rest over a distance of 1.62 m in a time of 0.86 s. It then continues at constant speed along a horizontal table until it reaches a ramp that is sloped at 11.5°. Assuming negligible friction, how far up the ramp does the cart go before stopping? Hint: first find the cart speed after launch; then use components to find the deceleration up the ramp.

→ a 2-part problem

Part 1: the launch (acceleration)

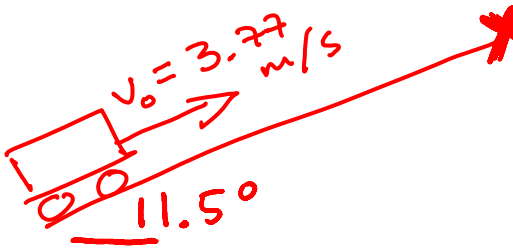
$v_0 = 0$
$d = 1.62\ m$
$t = 0.86\ s$
→ find v

$d = v_{av} t$

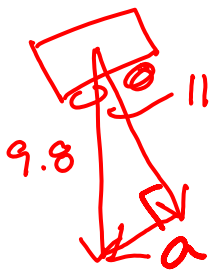
$1.62 = \left[\frac{v+0}{2}\right](0.86)$

$v = 3.77\ m/s$

Part 2: up the ramp



⇒ use components to find "a"



$\frac{a}{9.8} = \sin 11.5$

$a = -1.95\ m/s^2$ → negative because it opposes motion (cart is slowing down)

so: $v^2 = v_0^2 + 2ad$

$0 = 3.77^2 + 2(-1.95)d$

$\boxed{d = 3.64\ m}$